of the *felspars*. In some zeolites the ratio of aluminium to silicon is quite low, so we have justification for describing these structures as having acid radicals with endless extension in three dimensions. The bearing of this on the ease with which the water content is changed and metallic ions substituted in the zeolites without breaking down a crystal, is obvious.

These silicon-oxygen complexes are bound together by metallic ions, which fit into the spaces between the large oxygen atoms. The way in which the cations are incorporated is very interesting. I first pointed out the prevalence in silicate structures of close-packed regular groups of oxygen atoms, as if many cations such as $Be^{\cdot\cdot}$, $Al^{\cdot\cdot\cdot}$, $Mg^{\cdot\cdot}$, $Fe^{\cdot\cdot}$, $Ti^{\cdot\cdot\cdot\cdot}$ fitted into close-packed groups of four oxygen atoms at the corners of a tetrahedron, or six at the corners of an octahedron, with little distortion. Larger ions such as $K^{\cdot}$, $Ca^{\cdot\cdot}$, $Na^{\cdot}$ have often more oxygen atoms round them, and the group is distorted. This is natural, for while four or six spheres packed together assume a regular tetrahedral or octahedral form, eight spheres can be packed together more compactly by a less regular arrangement than that at the corners of a cube. In the next place, these metallic ions appear to be attracted to the oxygen atoms which have only *one* link to silicon. Oxygen atoms linked to two silicon atoms have little external field, as if their valency were saturated. It is very likely, as Lowry has insisted, that we must regard the silicon-oxygen link as wholly or partly a homopolar bond. Oxygen atoms with a single bond to silicon behave as if they had a single charge $-e$, those with a double bond as if they were uncharged. Another very important principle enters, which Pauling was the first to point out, in a general treatment of ionic compounds. The metallic atoms are so incorporated into the structure that there is a *local balancing of electric charge* between cations and the negatively charged oxygen atoms. These features are beautifully illustrated by models of silicate structures.

West and myself, in a paper on the structure of certain silicates in 1927, directed attention to the *importance of oxygen in silicate formulæ*. Oxygen atoms cannot be removed from the structure without breaking up the regular groups, and in most cases, owing to their relatively large size, additional oxygen atoms cannot be incorporated in the unit cell. This applies not only to the oxygen atoms which are linked to silicon, but also to additional ions O'', OH', F' which are part of the structure, the latter ions taking up the same space as oxygen. On the other hand, Al can replace Si or Mg, Mg, Fe, and Mn are interchangeable, Ca can replace Na, and so forth, in the familiar way. Hence in giving the atomic composition of a silicate after a chemical analysis has been made, the relative numbers of the constituents must be so expressed that the absolute number of oxygen atoms is correct for that particular type of crystal. This immensely simplifies the problem of composition in such substances as the silicates where isomorphous replacement is so frequent. Mauguin's work on the micas, Warren's on the amphiboles, and Berman's study of the melitite group, afford examples. The relatively large size of oxygen, and the constancy with which a distance of about 2·7 A. between oxygen centres appears in the silicate structures, make it convenient to think of the silicates as based on an oxygen framework which determines their dimensions, a fact of which considerable use was made in the earliest analyses.

Although so little ground has been covered, we can begin to see the general lines on which this interesting class of inorganic compounds is based. The technique of X-ray analysis has reached a stage where the complexity of the structure is no barrier, for examples already worked out are as complex as any we are likely to encounter.

A Large Power Plant at Billingham-on-Tees.

IN a paper read to the Institution of Electrical Engineers on Mar. 13, H. A. Humphrey, D. M. Buist, and J. W. Bansall gave a complete description of the new industrial power plant which has been erected by Imperial Chemical Industries, Ltd., for the factory at Billingham-on-Tees belonging to Synthetic Ammonia and Nitrates, Ltd. The conditions governing the design of this power plant differ from those relating to a public electricity supply station. The extension programme required nearly 7000 tons of steam per day for process purposes as well as 37,500 kilowatts of electrical power. The quantity of steam required for process purposes is double that required to generate the electrical energy. Hence the boiler plant capacity had to be made three times as great as if electrical power only had been required.

Chemical works have an almost constant load ; in technical language, their load factor is a hundred per cent and continuity of supply is of vital importance. A cessation of power would not only cause a loss of output, but would also upset the steady conditions of temperatures and pressures on which the satisfactory operation of the plant depends. The power plant, therefore, must have a sufficient stand-by plant and means for bringing that plant rapidly into operation. Everything has to be considered on the lines of ' safety first '. As the output of the plant has to be as great as that of the largest electricity station in Great Britain, great attention was paid to securing economy in the generating costs.

It was considered that 856° F. was the highest safe temperature for ordinary steel superheaters, as a great deal has yet to be learned about ' creep ' stresses at this temperature. Considerations of safety, therefore, led the designers to adopt a maximum boiler pressure of 815 lb. per square inch. As high pressure boilers must have distilled water feed, and as only sixty per cent of the necessary supply could be obtained from the condensed steam, 2500 tons of water have to be distilled every day to add to the ' make up ' feed.

By passing the total amount of steam generated, including that required for process purposes, 23,800 kilowatts are obtained. Two turbo-alternators, each of 12,500 kilowatts, provide the working units, and one is added as a reserve. It was stated that the estimated cost of the electric energy generated in the station is well below the cost of any electric generating station in the world depending on coal as fuel. This is attributed to the use of the high pressure and high temperature steam. The primary turbines pass a greater quantity of steam than would be available in an ordinary power station. Owing to the locality, the coal is cheap, and there is an abundant supply of cooling water. The load factor also is the highest possible.

An ingenious method of supplying the two boiler and pulveriser buildings is adopted. The raw coal is brought in by rail and dropped into underground bunkers, from which it is raised by hoists to overhead belt conveyors. It is thus carried to overhead steel bunkers in the pulveriser house, where it falls through chutes to the weighers and thence to the mill hoppers, where it is pulverised. It is next carried to an overhead cyclone separator by an air stream driven by exhauster fans. From the cyclones the pulverised coal drops through rotary air locks to screw conveyors, which distribute it to the fuel bunkers, of which there is one to each boiler. From these bunkers the powder passes through feeders driven by motors, the speed of which can be varied. Finally, it is picked up by the air stream from the primary air fans and fed to the burners. The air for combustion is supplied by forced draught fans after having been brought to a temperature of about 500° F. by preheaters.

The main generating units consist of three 12,500 kw. high pressure primary units and two 12,500 kw. intermediate pressure condensing turbines. The turbines run at 2400 revolutions per minute, and are direct-coupled to three phase alternators. This station marks an important advance in the design of high temperature and high pressure power plants. It is the largest high pressure pulverised fuel plant in the world.

University and Educational Intelligence.

Manchester.—A Consultative Committee on Cancer Research consisting of representatives of the University and of the Manchester Committee on Cancer, including the Christie Hospital and the Radium Institute, has been established. The research work will be conducted in the University laboratories and will be directed and controlled by the Consultative Committee. Dr. C. C. Twort, who has been working nder uthe direction of the Manchester Committee on Cancer, has been appointed as director of the Department of Cancer Research.

Oxford.—The Latin oration delivered on Mar. 19 by the outgoing Senior Proctor, Mr. L. H. Dudley Buxton, of Exeter College, contained an appreciative reference to Prof. R. V. Southwell, who comes from Cambridge to succeed Dr. Frewen Jenkin as professor of engineering science; and to Prof. R. Robinson, who takes the place of the late Prof. W. H. Perkin in the Waynflete chair of chemistry. A tribute was paid to the skill of the latter in the by-paths of music and horticulture. Reference was made to the increasing pressure upon library space caused in part by the desire of natural science to "extend beyond the flaming boundary walls of the universe". It was to be hoped that the labours of the Commission, the appointment of which was made possible by the munificence of our cousins in America, would be able to solve the difficult question of library accommodation. In view of the invasion of the seat of the Muses by factories, noisy motor traffic, and of the sky itself by aeroplanes and the smoke of furnaces, it was not wonderful that the Radcliffe Observer (Dr. Knox-Shaw) should have forsaken his post of observation for "thirsty Africa", where the stars are still visible through a cloudless atmosphere. Finally, the proposed zoological garden for the delectation of the populace is not regarded by all with approval.

The Royal Society of Medicine, 1 Wimpole Street, W.1, has accepted, as a trust, the sum of £1000 presented by Mr. Norman Gamble for the purposes of providing a prize of £50 every fourth year for the best original work in otology carried out by any British subject, lay or medical, during the preceding four years, the balance of the fund to be used for the purpose of awarding grants in aid of research work in otology. Applications for the prize and for grants in aid must be received by the secretary of the Society not later than Sept. 30 next.

Historic Natural Events.

Mar. 29-31, 1901. Snowstorms.—During the passage of a deep barometric depression across Ireland and Scotland. heavy snow fell in North Wales, Scotland, and the north of England, mainly on Mar. 29. In some places the depth of snow was three feet on level ground, and it was piled by the wind in great drifts, especially on the Snowdon Range.

Mar. 30, 1912. Antarctic Blizzard.—After reaching the south pole on Jan. 17, Scott met with calms and light winds with powdery snow which formed a great hindrance to travel. Finally, on Mar. 20, a blizzard set in, so thick and violent that his party could not leave their tent. A gale from west-south-west and south-west continued for at least ten days, and was still blowing when Scott made the last entry in his diary on Mar. 30. Every day the party had been ready to start for the depot, only eleven miles away, which would have saved them, but the air was full of whirling drift, and travel was impossible.

Mar. 30, 1924. Floods.—The end of March and the beginning of April were marked by heavy rain and extensive floods in Europe, which were accentuated by a sudden thaw following a heavy snowfall. In Poland at the end of March the Vistula stood 27 feet above its normal level, a height said not to have been recorded since 1570, and there was much damage and suffering. In Jutland a newly built dam burst, and in Spain and Portugal the rivers overflowed their banks; Seville was flooded and many persons were drowned. There were extensive landslides in Granada and northern Italy, and in Switzerland traffic was impeded by the heavy falls of snow which blocked the passes.

April 1, 1427. Heavy Rain.—It is recorded in Fabyan's "Chronicles" that "This yere was unreasonable of Wederynge, for it reyened mosli contynually from Ester to Myghelmasse, where through hay and corne was greatly hyndered".

April 1, 1917. Great Snowstorm.—On the afternoon and evening of April 1, which was Palm Sunday, heavy snow fell in western Ireland, especially in East Clare. By 5.30 P.M. it was nine inches deep on the roads about Broadford, and on the morning of April 2 all the roads were blocked by snow-drifts several feet deep. More snow fell on April 3, and the roads were not freed until the following day. On the night of April 1, there was an intense frost, and two men riding home over a mountain pass were killed by the cold.

April 1, 1922. Landslide. Heavy rains in Switzerland at the beginning of the month caused a serious landslide near Le Bouveret (Valais), in the Rhone valley. The village of Les Evouettes was partially buried. Floods were afterwards reported from all parts of the country and also in the Rhone valley in France; at Lyons the lower part of the town was under water. There was a considerable amount of minor damage by avalanche and landslide throughout the month, owing to the continued rainfall.

April 2-3, 1909. Heavy Rain.—With depressions in the Atlantic and Mediterranean, heavy rain fell over the greater part of Ireland. The average rainfall in the two days over the whole island was 1·69 in., corresponding with a total precipitation of 3558 million tons, or 797,000 million gallons of water. The heaviest falls occurred in the south and south-west, where several places received more than five inches.

April 3, 1901. Blood-rain Plant. During March and April the large evaporation tank at the former headquarters of the British Rainfall Organization in Camden Square was invaded by a microscopical water-plant, which on April 3 was identified by Mr.